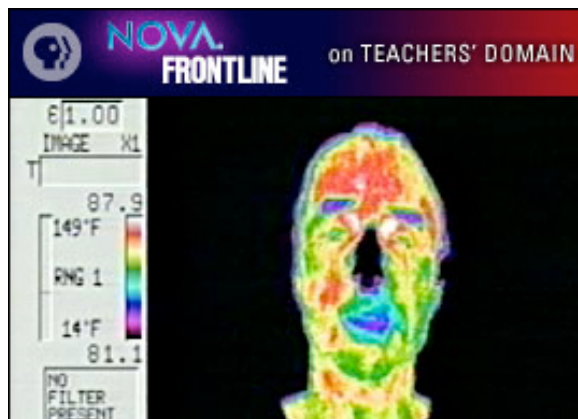




GLOBAL WARMING: CARBON DIOXIDE AND THE GREENHOUSE EFFECT

Video Summary

Human activities are causing increasing amounts of carbon dioxide to be pumped into the atmosphere. Is this increase resulting in global warming? Most climate experts see a distinct correlation between increased atmospheric CO₂ concentrations and rising global temperatures. This video segment adapted from NOVA/Frontline provides a generally accepted explanation by illustrating the heat absorbing role carbon dioxide plays in our atmosphere.



www.teachersdomain.org/resources/phy03/sci/ess/watcyc/co2

Topics Covered:

– Earth and Space Science:

[Water Cycle, Weather, and Climate](#)

Recommended for Grades 6-12

Media Type: QuickTime Video

Video Length: 2m 26s

Permitted use: Download, Share, Remix

Media Available for Purchase: [Buy this full program on DVD](#)

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Discussion Questions

- Why does the image of the scientist in the video segment fade after carbon dioxide has been turned on? How does this explain the greenhouse effect?
- Draw a diagram that explains how radiant energy from the Sun heats Earth's atmosphere. Show how heat is absorbed and reradiated by both Earth and the greenhouse gases in the atmosphere.
- What personal actions do you think might contribute to the amount of carbon dioxide entering the atmosphere, either by increasing it or decreasing it?
- How long does it take for carbon dioxide to spread throughout Earth's atmosphere? How long does it take to be absorbed into the oceans?
- Under what circumstances do you think carbon dioxide in Earth's atmosphere becomes harmful? Explain.

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Background Essay

Carbon cycles naturally through the environment. Plants and other photosynthetic organisms extract carbon dioxide from the air and, in the presence of light, make food in the form of the carbohydrate glucose, which provides energy and is used to build and repair structures. Both animals and plants return CO₂ to the air when they release the energy stored in food molecules through the process of respiration. Other carbon-based molecules cycle more slowly through the environment, remaining stored underground or at the bottom of the ocean for long periods of time.

When we extract coal and oil from Earth's crust and then burn these fossil fuels to provide energy for transportation, heating, cooking, electricity, and manufacturing, we add carbon to the atmosphere more rapidly than it is naturally removed through photosynthesis and sedimentation. The result is that atmospheric carbon dioxide concentrations are higher today than they have been for at least 400,000 years.

This human-caused increase is a concern to climate experts because carbon dioxide, water vapor, methane, nitrous oxide, and a few other compounds are responsible for keeping Earth warm in the first place. Scientists' concern is that an increase in greenhouse gases is likely to enhance the greenhouse effect.

Greenhouse gas molecules, each composed of three or more component atoms, readily absorb infrared radiation coming from the surface of Earth. When they do, they vibrate and ultimately re-emit the radiation they have absorbed. Often, they simply pass their energy to nearby greenhouse gas molecules. This absorption-emission-absorption cycle in the lower atmosphere keeps heat near the surface of Earth, effectively insulating it from the cold of space.

In the proper balance, greenhouse gases make life on Earth possible. However, any increase in their concentration poses the risk of altering the natural balance and changing global temperatures dramatically. Indeed, temperature data from a variety of sources show that average global temperatures have risen slightly less than one degree Celsius in the past century. What may sound like a small change actually suggests an alarming trend to many climate experts. After all, ice ages and the warm interglacial periods between them are marked by changes of just four or five degrees Celsius. A warming trend on top of the current interglacial period could have devastating consequences for human societies.

To learn more about the role CO₂ plays in Earth's temperature, check out [Global Warming: The Physics of the Greenhouse Effect](#).

To learn more about evidence suggesting a link between human activities and global warming, check out [CO₂ Concentrations at Mauna Loa Observatory, Hawai'i](#).

To learn more about evidence of regular, extreme climate change throughout Earth's distant past, check out [Climate Change](#) and [Greenland Ice Sheet Project 2: A Record of Climate Change](#).

Lessons Plans Using This Resource:

- [Global Climate Change: Understanding the Greenhouse Effect](#)

Professional Development Courses Using This Resource:

- [Teaching Earth and Space Science](#)
- [Weather and Climate](#)

Curricular Standards Correlations:

NSES, Project 2061, MCREL, and state standards correlations available at www.teachersdomain.org. (Free registration required for your specific state standards correlated to this resource.)

Source: *FRONTLINE/NOVA*: "What's Up With the Weather?"

Materials used courtesy of:

WGBH Educational Foundation:

c/u hose into box (CO₂, carbon dioxide experiment), c/u camera peering into box with cellophane put over it (CO₂, carbon dioxide experiment), Pieter Tans, NOAA, sits down for CO₂, carbon dioxide experiment, Pieter Tans, NOAA, explaining CO₂, carbon dioxide experiment, c/u cellophane put over box (CO₂, carbon dioxide experiment), c/u flir thermacam image during CO₂, carbon dioxide experiment, c/u woman turns valve during CO₂, carbon dioxide experiment, c/u flir thermacam image during CO₂, carbon dioxide experiment, m/s man gathers air sample off of Mauna Loa Observatory, time lapse clouds, Interview with Pieter Tans, NOAA

Scripps Institution of Oceanography, UCSD: Man with a beard gathers air sample on beach (Mauna Loa / Hilo)

NASA: View of earth from space

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